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November 16, 2004

Date of Signature

Re: Application of: Charles E. May
Serial No.: 09/943,196
Filed: August 30, 2001
For: Arrangement and Method for Fabricating A
Semiconductor Wafer
Group Art Unit: 1765
Examiner: Lynette T. Umez-Eronini
Our Docket No.: 01-146 (1003-0606)

TRANSMITTAL OF BRIEF ON APPEAL

Please find for filing in connection with the above patent application the following documents:

1. Original of the Appeal Brief;
2. Three (3) copies of the Appeal Brief; and
3. One (1) return post card.

Commissioner for Patents

November 16, 2004

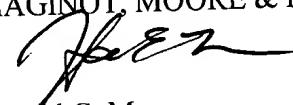
Page 2

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Respectfully Submitted,

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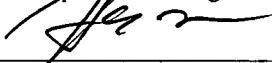
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BRIEF ON APPEAL

Sir:

This is an appeal under 37 CFR § 1.191 to the Board of Patent Appeals and Interferences of the United States Patent and Trademark Office from the final rejection of claims 1, 3, 5-8, 12, 14 and 21 of the above-identified patent application. These claims were indicated as finally rejected in an Office Action dated June 16, 2004. Three copies of the brief are filed herewith. Please charge \$340.00 to Deposit Account No. 12-2252 to cover the fee required under 37 CFR § 1.17(f). Also, please provide any extension of time which may be necessary and charge any fees which may be due to Deposit Account

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(1) REAL PARTY IN INTEREST

LSI Logic Corporation is the owner of this patent application, and therefore the real party in interest.

(2) RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences related to this patent application.

(3) STATUS OF CLAIMS

Claims 1, 3, 5-17 and 21 are pending in the application.

Claims 1, 3, 5-8, 12, 14 and 21 stand rejected and form the subject matter of this appeal. Claims 9-11, 13 and 15-17 are objected to, but deemed to include allowable subject matter. Claims 1, 3, 5-17 and 21 are shown in the Appendix attached to this Appeal Brief.

(4) STATUS OF AMENDMENTS

Applicants filed a Response to Office Action dated April 17, 2003 ("First Response") responsive to an Office Action dated January 17, 2003. A final Office Action dated May 6, 2003 was designated by the Examiner to be responsive to the First Response. On August 6, 2003, Applicants filed a Request for Continued Examination and a Response to Office Action ("RCE Response") responsive to the final office action dated May 6, 2003. The Examiner issued a new non-final office action dated August 29,

2003 responsive to the RCE Response. In response to the new non-final office action, the Applicants filed a Response to Office Action dated December 29, 2003. The Examiner thereafter issued a second final Office Action dated June 16, 2004.

(5) SUMMARY OF THE INVENTION

Claim 1 is directed to a method that includes the steps of disposing a volume of an aqueous slurry containing an abrasive material onto a semiconductor wafer and polishing the semiconductor wafer with a polishing pad. Claim 1 further recites the step of disposing a volume of a nonaqueous solvent onto the semiconductor wafer. Thus, the semiconductor is initially subjected to an aqueous slurry, and then a nonaqueous solvent is introduced during the polishing. (See non-limiting examples in Application at page 8, lines 12-23 and Figs. 1 and 2).

Claim 21 includes a step of mixing an aqueous slurry containing an abrasive material and a nonaqueous solvent in a mixing unit so as to create an aqueous slurry/nonaqueous solvent mixture prior to being disposed onto the semiconductor wafer. (See non-limiting example in Application at page 13, lines 10-21).

(6) ISSUES

Whether claims 1, 3 and 12 are unpatentable under 35 U.S.C. § 102(a) as allegedly being anticipated by Farkas et al., U.S. Patent No. 6,001,730 (hereinafter “Farkas”).

Whether claims 5 and 6 are unpatentable under 35 U.S.C. § 103(a) as allegedly being obvious over Farkas in view of U.S. Patent No. 5,985,045 to Kobayashi (hereinafter “Kobayashi”).

Whether claim 7 is unpatentable under 35 U.S.C. § 103(a) as allegedly being obvious over Farkas in view of U.S. Patent No. 6,436,830 to Merchant et al. (hereinafter “Merchant”)

Whether claims 8 and 14 are unpatentable under 35 U.S.C. § 103(a) as allegedly being obvious over Farkas in view of U.S. Patent No. 5,780,358 to Zhou et al. (hereinafter “Zhou”);

Whether claim 21 is unpatentable under 35 U.S.C. § 103(a) as allegedly being obvious over Farkas in view of Kobayashi.

(7) GROUPING OF CLAIMS

The claims do not all stand or fall together.

Claims 1, 7 and 8 form a first separately patentable group which is argued independently of the other claims for purposes of this appeal.

Claims 3, 12, 13 and 14 form a second separately patentable group which is argued independently of the other claims for purposes of this appeal.

Claim 21 forms a third separately patentable group which is argued independently of the other claims for purposes of this appeal.

Claim 5 forms a fourth separately patentable group which is argued independently of the other claims for purposes of this appeal.

Claim 6 forms a fifth separately patentable group which is argued independently of the other claims for purposes of this appeal.

(8) ARGUMENT

First Claim Grouping: **Claims 1, 7 and 8 are Not Unpatentable**

Discussion re: Patentability of Claim 1

1. Claim 1

Claim 1 is directed to a method of fabricating a semiconductor wafer. Claim 1 includes the following limitations:

- (a) disposing a volume of an aqueous slurry containing an abrasive material onto a semiconductor wafer and polishing the semiconductor wafer with a polishing pad; and
- (b) disposing a volume of a nonaqueous solvent onto said semiconductor wafer.

Thus, claim 1 recites the use of both an aqueous slurry and a nonaqueous solvent, the nonaqueous solvent disposed on the semiconductor wafer.

2. The Examiner's Anticipation Rejection Should be Reversed

The Examiner rejected claim 1 as allegedly being anticipated by Farkas. However, Farkas fails to disclose, teach or suggest disposing an aqueous slurry on and polishing a semiconductor and *adding a nonaqueous solvent to the semiconductor wafer*. Farkas therefore fails to disclose a method that includes the steps of 1) disposing a volume of an aqueous slurry containing an abrasive material onto a semiconductor wafer and polishing the semiconductor wafer with a polishing pad, and 2) disposing a volume of a nonaqueous solvent onto said semiconductor wafer, as called for in claim 1. Accordingly, the anticipation rejection of claim 1 over Farkas is in error and should be reversed.

B. The Examiner's Rejection

The Examiner alleged that Farkas anticipates claim 1. The Examiner correctly points out that Farkas states that the “slurry 24, illustrated in FIG. 3, contains . . . an abrasive slurry/agent, a solvent, . . .” The Examiner also correctly notes that Farkas states that “Typical solvents used in the slurry 24 of FIG. 2 is one or more of dionized water . . . or an alcohol”, and that a “remaining balance of the slurry is typically deionized water and/or an alcohol solution”. (June 16, 2004 Final Office Action pp.2-3).

However, while Farkas arguably suggests the possibility of using dionized water *and* alcohol as solvents, Farkas does not teach using an aqueous slurry for polishing and *disposing a nonaqueous solvent on the semiconductor wafer*. At best, Farkas may suggest that at some point, both water and alcohol may be used as solvents for a slurry. However, Farkas contains *no* discussion of how the water and alcohol solvents are mixed or in what order they are introduced to the abrasive component of the slurry.

Farkas simply does not suggest that an aqueous *slurry* and a nonaqueous *solvent* are *even* mixed at all. Thus, for example, the water and alcohol solvents of Farkas may be mixed together prior to generating the slurry. Similarly, a nonaqueous slurry may be generated, and then mixed with an aqueous solvent. Finally, nothing in Farkas suggests that the either of the solvents is disposed onto the semiconductor wafer separately from the slurry.

For the foregoing reasons, it is respectfully submitted that Farkas fails to teach, disclose or suggest all of the elements of claim 1. As a consequence, the anticipation rejection of claim 1 is in error and should be withdrawn.

Discussion re: Patentability of Claims 7 and 8

Claims 7 and 8 all stand rejected over Farkas as applied to claim 1 in view of either Merchant or Zhou. (Final Office Action dated June 16, 2004). Claims 7 and 8 both depend from and incorporate all of the limitations of claim 1. It is respectfully submitted that neither Merchant nor Zhou were cited for, and that they do not address, the shortcomings of Farkas with respect to claim 1. (See *id.* at pp.5-6). Accordingly, even if there was a motivation or suggestion to combine either Merchant or Zhou with Farkas as proposed by the Examiner, the resulting combination would not arrive at the invention of either of claims 7 or 8 for at least the same reasons as those set forth above in connection with claim 1. It is therefore submitted that the obviousness rejections of claims 7 and 8 should be reversed.

**Second Claim Grouping: Claims 3 and 12-14 are Not
Unpatentable**

Discussion re: Patentability of Claim 3

1. Claim 3 Depends from Claim 1

As an initial matter, claim 3 depends from and incorporates all of the limitations of claim 1. Accordingly, the rejection of claim 3 as anticipated by Farkas should be reversed for at least the same reasons as those set forth above in connection with claim 1.

2. Additional Limitations of Claim 3

Claim 3 also recites the following limitations:

said polishing pad is in contact with said semiconductor wafer when said nonaqueous solvent is disposed onto said semiconductor wafer.

Thus, in contrast to claim 1, claim 3 recites that the polishing pad is in contact with the wafer when the nonaqueous solvent is disposed onto the wafer.

3. Claim 3 is Patentable Over Farkas for Additional Reasons

In addition to the reasons set forth above in connection with claim 1, claim 3 is patentable over Farkas because Farkas neither teaches nor suggests that the polishing pad is in contact with the wafer when the wafer receives the nonaqueous solvent.

In particular, in the explanation of the rejection of claims 1, 3 and 12, the Examiner specifically cited language that appears to teach away from this limitation of claim 1. In particular, the Examiner provided the following reasoning, which includes cited portions of column 5 of Farkas:

"The copper layer 22 of FIG. 1 [of Farkas] is placed into contact with a chemical mechanical polishing slurry 24 as illustrated in FIG. 3. The . . . polishing pad 26 in the CMP tool is placed in contact with the slurry 24 and is mechanically rotated and applied with pressure in order to result in effective chemical/mechanical removal of upper portions of the layer 22 in FIG. 3." (column 5, lines 35-42)

(Cited in June 16, 2004 final Office Action at p.2). The Examiner further states that Farkas teaches that the slurry 24 may contain, as solvent, "one or more of deionized water . . . or an alcohol". (*Id.*)

The above cited language plainly teaches that the slurry is in contact with the wafer *prior* to contacting the polishing pad. Thus, even if the slurry 24 were assumed to contain a nonaqueous solvent (alcohol), such nonaqueous solvent would contact the wafer *before* the wafer is contacted by the polishing pad, and not after. The Examiner cites no other teaching in Farkas that a solvent is added to the wafer once it is in contact with the polishing pad.

Farkas therefore does not teach or suggest a limitation in which the polishing pad is in contact with said semiconductor wafer when a nonaqueous solvent is disposed onto said semiconductor wafer. Accordingly, for reasons in addition to those set forth above in connection with claim 1, the Applicant requests that the Board reverse the anticipation rejection of claim 3.

Discussion re: Patentability of Claim 12

Claim 12 also stands rejected as allegedly anticipated by Farkas. Claim 12 has limitations similar to those discussed above in connection with claim 3. Namely, claim 12 includes performing chemical mechanical polishing ("CMP") using an aqueous slurry and also disposing a nonaqueous solvent onto the wafer. As discussed above in connection with claim 1, Farkas does not teach using an aqueous slurry in CMP and then

adding a nonaqueous solvent. Farkas only mentions that a slurry may have a water and/or an alcohol solvent. Moreover, similar to claim 3, claim 12 recites that the nonaqueous solvent is added *during the chemical mechanical polishing*. As discussed above in connection with claim 3, Farkas teaches away from adding any nonaqueous solvent while polishing is occurring. Accordingly, for at least the same reasons as those set forth above in connection with claim 3, it is submitted that the anticipation rejection of claim 12 should be reversed.

Discussion re: Patentability of Claims 13-14

Claim 14 stands rejected over Farkas as applied to claim 12 in view of Zhou. (Final Office Action dated June 16, 2004). Claim 14 depends from and incorporates all of the limitations of claim 12. It is respectfully submitted that Zhou was not cited for, and does not address, the shortcomings of Farkas with respect to claim 12. (See *id.* at p.6). Accordingly, even if there was a motivation or suggestion to combine Zhou with Farkas as proposed by the Examiner, the resulting combination would not arrive at the invention of claim 14 for at least the same reasons as those set forth above in connection with claim 12. It is therefore submitted that the obviousness rejection of claim 14 should be reversed.

Claim 13 is patentable for similar reasons.

**Third Claim Grouping: Claim 21 is Not Obvious
Over Farkas and Kobayashi**

Discussion re: Patentability of Claim 21

1. Claim 21

Claim 21 is also directed to a method of fabricating a semiconductor. The method includes the step of:

mixing an aqueous slurry containing an abrasive material and a nonaqueous solvent in a mixing unit so as to create an aqueous slurry/nonaqueous solvent mixture prior to being disposed on said semiconductor wafer;

Thus, claim 21 differs from other claims in that the aqueous slurry and nonaqueous solvent are mixed in a mixing unit prior to application to the wafer.

2. No Prima Facie Case of Obvious Set Forth.

In the rejection of claim 21, the Examiner acknowledged that Farkas fails to teach such a mixing step. (June 16, 2004 office action at p.7). Nevertheless, the Examiner instead alleged that Kobayashi provided such a teaching. The Examiner's reasons for the rejection are set forth below:

Kobayashi teaches, "A chemical-mechanical polisher (10) includes a mixer section (12) that mixes components of a polishing fluid prior to introducing the polishing fluid onto a polishing section (13) of the polisher (10)" (Abstract). "For example, container 111 may include concentrated polishing fluid, and container 112 includes a diluent, such as water, an alcohol, a glycol, and the like" (column 3, lines 17-19). "A polishing fluid may only include liquids or include at least one liquid and particles" . . . which provides evidence that Kobayashi's polishing fluid is the same as applicants aqueous slurry and further reads on, mixing said aqueous slurry and said nonaqueous solvent in a mixing unit. . .

(June 16, 2004 office action at p.7).

Applicants disagree that Kobayashi “provides evidence that Kobayashi’s polishing fluid is the same as applicants aqueous slurry” as contended by the Examiner. Kobayashi teaches mixing a “concentrated polishing fluid” with a “diluent”. Nowhere in Kobayashi does it teach whether the *concentrated* polishing fluid is aqueous or nonaqueous. Moreover, Kobayashi certainly does not teach that the polishing fluid is *aqueous* and that it is mixed in a mixing unit with a *nonaqueous* solvent.

While the concentrated polishing fluid *could* be an aqueous slurry, it *could also* be a nonaqueous slurry, or a combination of both. Moreover, it would stand to reason that the “diluent” in the container 112 would be consistent with the existing solvent in the concentrated fluid. In other words, if the concentrated polishing fluid contains alcohol, then the diluent in the container 112 would be alcohol, and if the concentrated polishing fluid instead contains water, then the diluent in the container 112 would contain water.

Thus, nothing in Kobayashi could be interpreted as suggesting mixing an aqueous slurry with a nonaqueous solvent. In fact, it would appear that an aqueous slurry would be mixed with an aqueous diluent.

In any event, the mere fact that a concentrated polishing fluid *may* be diluted with water, alcohol or glycol does not constitute a legally sufficient teaching or suggestion of mixing an aqueous slurry with a nonaqueous solvent.

As a consequence, it is respectfully submitted that the Examiner’s obviousness rejection is based on the faulty premise that Kobayashi mixes an aqueous slurry with a nonaqueous solvent. Because the obviousness rejection relies on an incorrect characterization of Kobayashi, it is respectfully submitted that the Examiner has failed to make out a *prima facie* case of obviousness with respect to claim 21.

Accordingly, for at least this reason, it is respectfully submitted that the rejection of claim 21 is in error and should be reversed.

**Fourth Claim Grouping: Claim 5 is Not Obvious
Over Farkas and Kobayashi**

Discussion re: Patentability of Claim 5

1. Claim 5

As an initial matter, claim 5 depends indirectly from and incorporates all the limitations of claim 21. Accordingly, claim 5 is patentable over the prior art for at least the same reasons as those set forth above in connection with claim 21.

2. Additional Limitations of Claim 5

Claim 5 also recites the following limitations:

increasing the weight % of said nonaqueous solvent in said aqueous slurry/nonaqueous solvent mixture during said polishing. . .

Thus, claim 5 involves mixing the nonaqueous solvent with the slurry in a mixing unit prior to polishing (base claim 21), and then increasing the weight % of the nonaqueous solvent during polishing.

3. Claim 5 is Patentable Over Farkas and Kobayashi for Additional Reasons

In addition to the reasons set forth above in connection with claim 21, claim 5 is patentable over Farkas and Kobayashi because the combination of those references does not arrive at the invention. The Examiner admits as much. (June 16, 2004 Office Action

at p.8).

A. The Examiner Asserts Additional Teachings Without Prior Art

The Examiner admitted that neither Farkas nor Kobayashi teaches increasing the weight % of nonaqueous solvent during polishing. (*Id.*) Instead, the Examiner cites general knowledge in the art. The Examiner's explanation of the rejection of claim 5 (and claim 6) is set forth below:

It is known that abrasive slurries can scratch a semiconductor surface and increasing the said solvent concentration would result in the solvent becoming a bulk solution that would thereby dilute the components of the slurry until their concentration become negligible. Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to use a known method of increasing the concentration of a solvent for the purpose of reducing the degree of scratching due to the present of abrasive materials.

(June 16, 2004 Office Action at p.8).

The Examiner has not cited any prior art reference containing the teachings of adding a nonaqueous solvent, during polishing, to premixed abrasive slurries. Even if such techniques were "known" at the time of the June 16, 2004 Office Action, there is no evidence that the techniques cited by the Examiner were in use or known at the time the invention was made. It is not clear at what date the Examiner alleges that the above cited techniques were publicly used, nor how the Examiner ascertains or estimates that date. The Examiner therefore has not made out a *prima facie* case that such teaching existed prior to the filing date of the application, much less prior to the Applicant's invention date.

For at least this reason, the rejection of claim 5 is in error and should be reversed. In particular, the combination of art cited by the Examiner, Farkas and Kobayashi, admittedly fails to arrive at the invention of claim 5.

**Fifth Claim Grouping: Claim 6 is Not Obvious
Over McNamara**

Discussion re: Patentability of Claim 6

1. Claim 6

As an initial matter, claim 6 depends from and incorporates all the limitations of claim 5. Accordingly, claim 6 is patentable over the prior art for at least the same reasons as those set forth above in connection with claim 5.

2. Additional Limitations of Claim 6

Claim 6 also recites the following limitations:

said weight % of said nonaqueous solvent . . . is increased until said . . . mixture is substantially free of said aqueous slurry.

Thus, even if one could argue that diluting a mixture with additional nonaqueous solvent, as recited in claim 5, constitutes no more than an obvious modification, it is not an obvious modification to continue to dilute the mixture until the aqueous slurry is substantially gone. The prior art simply Accordingly, claim 6 is patentable over the prior art for reasons in addition to those set forth above in connection with claim 5.

Accordingly, for at least this reason in addition to those set forth above in connection with claim 5, it is respectfully submitted that the rejection of claim 6 is in error and should be reversed.

(9) CONCLUSION

For all of the foregoing reasons, claims 1, 3, 5-8, 12, 14 and 21 are not unpatentable under 35 U.S.C. § 102(b) or 35 U.S.C. § 103(a). As a consequence, the Board of Appeals is respectfully requested to reverse the rejection of these claims.

Respectfully submitted,



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CLAIM APPENDIX

Claim 1. A method of fabricating a semiconductor wafer, comprising:

- (a) disposing a volume of an aqueous slurry containing an abrasive material onto a semiconductor wafer and polishing the semiconductor wafer with a polishing pad; and
- (b) disposing a volume of a nonaqueous solvent onto said semiconductor wafer.

Claim 2 (canceled).

Claim 3. The method of claim 1, wherein:

said polishing pad is in contact with said semiconductor wafer when said nonaqueous solvent is disposed onto said semiconductor wafer.

Claim 4 (canceled).

Claim 5. The method of claim 21, further comprising increasing the weight % of said nonaqueous solvent in said aqueous slurry/nonaqueous solvent mixture during said polishing of said semiconductor wafer.

Claim 6. The method of claim 5, wherein:

said weight % of said nonaqueous solvent in said aqueous slurry/nonaqueous solvent mixture is increased until said aqueous slurry/nonaqueous solvent mixture is substantially free of said aqueous slurry.

Claim 7. The method of claim 1, wherein:

said nonaqueous solvent includes an ammine.

Claim 8. The method of claim 1, wherein:

said nonaqueous solvent includes dimethylsulfoxide.

Claim 9. The method of claim 1, wherein:

said nonaqueous solvent includes N,N-propanalamide.

Claim 10. The method of claim 1, wherein:

said nonaqueous solvent includes analine.

Claim 11. The method of claim 1, wherein:

said nonaqueous solvent includes N,N-dimethlyanaline.

Claim 12. A method of fabricating a semiconductor wafer, comprising:

- (a) subjecting a front side of said semiconductor wafer to chemical mechanical polishing using an aqueous slurry; and
- (b) disposing a volume of a nonaqueous solvent onto said front side of said semiconductor wafer during said chemical mechanical polishing.

Claim 13. The method of claim 12, wherein:

 said nonaqueous solvent includes an ammine.

Claim 14. The method of claim 12, wherein:

 said nonaqueous solvent includes dimethylsulfoxide.

Claim 15. The method of claim 12, wherein:

 said nonaqueous solvent includes N,N-propanamide.

Claim 16. The method of claim 12, wherein:

 said nonaqueous solvent includes analine.

Claim 17. The method of claim 12, wherein:

 said nonaqueous solvent includes N,N-dimethylaniline.

Claims 18-20 (canceled).

Claim 21. A method of fabricating a semiconductor wafer, comprising:

- (a) mixing an aqueous slurry containing an abrasive material and a nonaqueous solvent in a mixing unit so as to create an aqueous slurry/nonaqueous solvent mixture prior to being disposed onto said semiconductor wafer;
- (b) disposing a volume of the aqueous slurry/nonaqueous solvent mixture containing an abrasive material onto a semiconductor wafer; and
- (c) polishing the semiconductor wafer with a polishing pad.